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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/623,016	07/17/2003	Sangheon Lee	LMRX-P019/P1154	4601

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EXAMINER	
DEO, DUY VU NGUYEN	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 06/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/623,016	LEE ET AL.	
	Examiner	Art Unit	
	DuyVu n. Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11,13-20,24-31,33-40 and 45-48* is/are rejected.

7)☒ Claim(s) *12,21-23,32 and 41-44* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 July 2003* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *4/21/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-11, 13-20, 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen et al. (US 6,528,426) and Leon et al. (US 2003/0235996).

Olsen describes a method for forming interconnect or dual damascene process comprising: providing a substrate having low-k dielectric layers above SiC etch stop layers, which are disposed above a copper layer (col. 3, line 35-48; col. 4, line 33-68); etching through the dielectric layer using a first etchant such as fluorine-based plasma (col. 4, line 2; col. 5, line 4, 5); etching through the SiC using a second etchant such as Cl2, which is different from the first etchant, to form openings (col. 4, line 1). Unlike claimed invention, Olsen doesn't describe performing a wet treatment using a solution of acetic acid and ammonium hydroxide. Leon teaches a method for cleaning wafer substrates wherein he uses a solution containing acetic acid and ammonium hydroxide (paragraphs [0022,0032]). It would have been obvious for one skilled in the art to modify Olsen's method in light of Leon's teaching of the cleaning solution because Leon teaches the solution would remove plasma etch residues formed on the wafer substrate after the plasma etching of the metal and dielectric layer.

Referring to claim 4 the low-k dielectric layers disclosed by Olsen would have dielectric constant of less than 4.

Referring to claims 5 and 6, etching through the etch stop SiC layer is performed through openings in the dielectric layer (Olsen: fig. 1i, 1h).

Referring to claims 9, 18, Leon's ammonium hydroxide concentration includes 0.001-1 wt %, which would overlap claimed 0.5-10% by V (paragraph [0033]).

Referring to claims 10, 11, 19, 20, Leon's acetic acid concentration is about 0.01-10 wt %, which would overlap claimed 1-99.7 % by V (paragraph [0023]).

3. Claims 26-31, 33, 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen et al. (US 6,528,426) and Shih et al. (US 6,797,627).

Olsen describes a method for forming interconnect or dual damascene process comprising: providing a substrate having low-k dielectric layers above SiC etch stop layers, which are disposed above a copper layer (col. 3, line 35-48; col. 4, line 33-68); etching through the dielectric layer using a first etchant such as fluorine-based plasma (col. 4, line 2; col. 5, line 4, 5); etching through the SiC using a second etchant such as Cl2, which is different from the first etchant, to form openings (col. 4, line 1). Unlike claimed invention, Olsen doesn't describe performing a DI rinse and then a H2 plasma treatment on the substrate. Shih teaches a same method wherein he teaches of performing a DI rinse and then a H2 plasma treatment on the substrate (col. 6, line 30-46). It would have been obvious for one skilled in the art to modify Olsen's method in light of Shih's teaching of DI rinse and H2 plasma treatment because he teaches that these treatments would remove the polymer residues and copper oxide residues from the substrate (ab.).

Referring to claim 30, the low-k dielectric layers disclosed by Olsen would have dielectric constant of less than 4.

Referring to claim 29, etching through the etch stop SiC layer is performed through openings in the dielectric layer (Olsen: fig. 1i, 1h).

4. Claims 36-40, 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen et al. (US 6,528,426) and Aoyama et al. (US 2005/0014667).

Olsen describes a method for forming interconnect or dual damascene process comprising: providing a substrate having low-k dielectric layers above SiC etch stop layers, which are disposed above a copper layer (col. 3, line 35-48; col. 4, line 33-68); etching through the dielectric layer using a first etchant such as fluorine-based plasma (col. 4, line 2; col. 5, line 4, 5); etching through the SiC using a second etchant such as Cl2, which is different from the first etchant, to form openings (col. 4, line 1). Unlike claimed invention, Olsen doesn't describe passivating the copper metal layer through the etch stop layer openings with a passivating solution that includes BTA. Aoyama describes a method for cleaning etching residues from substrate surface including copper wherein he uses a solution that contains BTA (paragraphs [0023,0044]) (claimed passivating solution that includes BTA. It would have been obvious for one skilled in the art to modify Olsen's method in light of Aoyama's teaching because he teaches that this solution would clean the etching residues from the substrate and he also teaches that the BTA is a corrosion inhibitor, which would passivate the copper metal.

Referring to claim 38, the low-k dielectric layers disclosed by Olsen would have dielectric constant of less than 4.

Referring to claim 39, etching through the etch stop SiC layer is performed through openings in the dielectric layer (Olsen: fig. 1i, 1h).

5. Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen and Aoyama as applied to claim 36 above, and further in view of Kirkpatrick et al. (US 6,861,348).

Unlike claimed invention, applied prior art above doesn't describe performing a H2 treatment on the substrate prior to the passivating. Kirkpatrick teaches a method of treating the low-k dielectric layer, which is the layer used by Olsen, with a H2 plasma treatment before a wet etching with HF/organic acid, which is similar to Aoyama's solution (col. 2, line 40-50). It would have been obvious for one skilled in the art to modify applied prior above in light of Kirkpatrick's teaching of using dry and wet treatment because Kirkpatrick teaches that this would reduce or eliminate resist poisoning of the low-k dielectric films (col. 2, line 5-8).

6. Claims 24, 25, 34, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Olsen/Leon or Olsen/Shih as applied to claims 13, 26 above, and further in view of Wang et al. (US 5,527,968).

Referring to claims 18 and 19, even though applied prior art above is silent about the type of plasma processing system is used; however such claimed systems of inductively and capacitively plasma system are known to one skilled in the art for plasma treatment of the substrate as shown here by Wang (col. 1, line 7-20), please also see cited art below. Therefore, it would have been obvious for one skilled in the art to use any known system such as capacitively or inductively system in order to provide a plasma for the etching or treatment of the substrate with a reasonable expectation of success.

7. Luo et al. (2002/0005392) is cited to show prior art.

Claim Objections

8. Claim 33 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 33 does not further limiting the claim since the DI water rinse already performed in claim 26.

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claim 33 recites the limitation "said wet treatment". There is insufficient antecedent basis for this limitation in the claim.

Allowable Subject Matter

11. Claims 12, 21-23, 32, 41-44 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

claims 12, 21-23, 32 are allowable because applied prior art doesn't suggest or teach (in claim 12 and 21) that (the substrate can be cleaned two times) a DI water rinse or HCl/DI water rinse (or clean) can be performed on the substrate prior to the wet treatment of the substrate with a solution contains acetic acid.

Claims 41-44 are allowable because applied prior art doesn't suggest or teach (claim 41) that performing a wet treatment on the substrate prior to passivating, the wet chemical treatment employing a solution that includes an organic acid or a mixture of an organic acid and a hydroxide.

Double Patenting

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

13. Claims 26-40, 45, 47 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-26 of copending Application No. 10/623,018. Although the conflicting claims are not identical, they are not patentably distinct from each other because they both describe a method of etching through an etch stop layer using chlorine gas and treating the substrate with a hydrogen containing and an inert gas.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on 6:00-3:30; with alternate Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Primary Examiner
Duy-Vu N. Deo
5/31/05